

of the contributions made by the succession of workers. He seeks to show how one step is related to others, often beyond the boundaries of biology. There is, for example, a very interesting passage in which he maintains that Darwin projected upon nature the contemporary ideal of the English state, his theory being, in fact, "a sociology of Nature." In parts Rádl's book shows an interpretative insight, which reminds us of Merz's "History of Intellectual Development in the Nineteenth Century," which is great praise; in other parts we think that he is quite unsound—notably in his curiously non-evolutionary contention that Darwinism is dead. Nor do we think that he is uniformly fair and accurate in his treatment of Darwinism, e.g., in a sentence like this:—"Die Theorie Darwins, welche jeden Glauben an die Gesetzmässigkeit der organischen Welt vernichtete, und alles Geschehen für eine Häufung von Zufällen hielt, konnte zwar für kurze Zeit die Welt blenden."

It is unsatisfactory to do no more than record dissent from Dr. Rádl's pronouncement that Darwinism is discredited, but the matter cannot be argued out in a few sentences. We might refer him, however, to some weighty considerations set forth in the fifth chapter of Sir Ray Lankester's "Science from an Easy Chair," which is entitled "Darwin's Theory Unshaken."

As we lay down the big book, our dominant impressions are that it is stimulating and even provocative, that it shows an extraordinary acquaintance with the literature, that it expresses a sometimes surprising appreciation of the importance of thinkers outside the ordinary schools (Samuel Butler, for instance), and that it carries one on with an undeniable swing, though it passes our understanding to discover the meaning of the detailed arrangement of the chapters.

#### SCIENCE IN SCHOOL.

*Broad Lines in Science Teaching.* Edited by F. Hodson, with an introduction by Prof. M. E. Sadler. Pp. xxxvi+267. (London: Christophers, n.d.) Price 5s. net.

**I**N the curricula of English schools a place, sometimes an important place, has been allotted to "science." The result has been to kindle intellectual interest in certain boys to whom the other work of the class-room made no appeal, as well as to direct the interests of the more studious to a wider field of intellectual exploration. Even more important has been the influence of the science-masters, who, having no well-worn groove of tradition along which to travel with the minimum of effort, have brought scientific method to the investigation of methods of teaching. Nevertheless, to many observers the effects of science teaching have been disappointing. Such critics demand that the average youth shall acquire the scientific way of looking at things. This is a very much larger demand than was realised in the early days, and it is the special aim of the book before us to present a broad view of the work which is involved in any sound curriculum which can make boys and girls of

secondary-school age the possessors of that which science has to give.

The volume contains a number (not strictly a series) of essays by writers who desire that the methods of science teaching should be built upon a fundamental study of the right relation of the growing mind towards new knowledge, new dexterities, new perceptions of duty. We may at once congratulate the editor on the *personnel* of the contributors and on the manner in which he and they have justified the title of the work. Prof. Sadler contributes an introduction, which is also somewhat in the nature of a review, and emphasises the necessity of first-hand study of nature. The place of science in the curriculum, its position in Germany, and the utility of examinations are discussed by the editor and Mr. Badley. Biological subjects receive a goodly share of attention in articles contributed by Miss von Wyss, Mr. Oswald Latter, and Miss Ravenhill. The chapter on geography is written by Mr. J. N. Stephenson, and is full of useful and sound criticism—obviously the work of an experienced and shrewd teacher. The relation of school work to the spiritual side of the pupil is discussed by the headmaster of Bedales and Miss Sanders, and in a measure by Prof. Powicke in his chapter on "Science in the Teaching of History." It is impossible within the limits of a short review to deal with these; the mention of them will serve to show the breadth of the editor's objective. Consideration is also given to the preliminary training of those who are to become farmers, housewives, engineers. In the last-mentioned case the writer considers the administrative and economic difficulties, but so rapidly are changes taking place in the organisation of educational courses for boys leaving school between the ages of fourteen and seventeen that no demerit attaches to the essays in which these aspects are omitted, as is usually the case in this volume.

Physics, chemistry, mathematics, are dealt with in the short space of forty to fifty pages. It would have been an improvement if more space had been given to these branches, even if this had involved the loss of the chapter on laboratory planning, which is not quite on the "broad lines" of the rest of the book. Teachers of chemistry should certainly read Dr. T. P. Nunn's essay on "The Place of Hypotheses in Science Teaching"; those who wish to train their pupils in the habit of independent thinking about phenomena and theories cannot fail to gain help from this searching probe into the tissues of our chemical belief.

The general impression produced by this book is encouraging. Especially marked is the thoroughness with which correlation between branches of the curriculum is made the basal plan of the educational structure. Correlation has ceased to be a word merely (blessed or the reverse), or at best a number of adventitious links between subjects mainly pursued apart; it is fast becoming an influence pervading the more progressive common-rooms and giving unity—but not monotony—to aims and methods in adjoining class-rooms. The subject of the chemistry-master is not primarily chemistry but boy. The writers of "Broad Lines" realise this. They also

realise the claims of practical application to health, morals, and livelihood, and seek to imbue school work and school life with the research habit and attitude of mind.

The volume is pleasant to read and handle; our main regret is that the essays are not twice their present length. We hope that this most opportune book will be widely read.

#### CLASSIC WALL-PAINTING.

*Greek and Roman Methods of Painting: Some Comments on the Statements made by Pliny and Vitruvius about Wall and Panel Painting.* By Dr. A. P. Laurie. Pp. vi+124. (Cambridge: University Press, 1910.) Price 2s. 6d. net.

DR. LAURIE, who is principal of the Heriot-Watt College at Edinburgh, has devoted much time and considerable ingenuity to the study of the materials and methods of painting. Many of his results are recorded in the *Journal of the Royal Society of Arts* and in other periodicals. But in the little book now before us we possess, in a detached and accessible form, an account of Dr. Laurie's latest studies on fresco- and wax-painting as described by Pliny and Vitruvius and practised in classic times. As the volume is not supplied with a table of contents, and is not divided into chapters, it may be well, in the present notice, to describe, in the order followed by the author, the several topics which he discusses.

The book opens with a review of the conditions under which the inquiry into ancient painting methods should be conducted. Then we pass on to the consideration of the pigments, both natural and artificial, which were available for use in early days. Dr. Laurie's list and his observations on several of the items which it comprises are of considerable interest. The murex purple, lately ascertained to be a dibrom-indigotin, and Egyptian blue, which was investigated by the late Dr. W. H. Russell, are important constituents of the ancient palette. A madder pigment was also in use, as well as indigo.

Primitive vehicles are next discussed, size, gum, milk, white and yolk of egg being included in the series of available mediums. Both bitumen and turpentine, or liquid resins and balsams, were known, but neither drying oils nor spirit varnishes. Beeswax played an important part as a painting vehicle; our author's studies and experiments confirm the modern view as to the process of encaustic painting as described by Pliny and illustrated by the wax portraits brought from the Hawara cemetery in the Fayum by Prof. Flinders Petrie. The doubts once expressed by Eastlake and other authorities as to the feasibility of painting with melted coloured waxes may now be regarded as not warranted. In some places the wax was mixed with a liquid resinous body, such as Venice turpentine; this mixture was more easy to manipulate than wax alone, but acquired greater hardness in the course of time.

Wax-painting was, however, not the ancient process in use for the decoration of walls; this was painting on wet or wetted lime-plaster with pigments mixed with water, or possibly on occasion with glue or size.

NO. 2131, VOL. 84]

Such fresco-painting is discussed by Dr. Laurie at some length. The process is not precisely that of the fourteenth century and the Italian Renaissance, the *buon fresco* of the historians of art. There are no joins or seams in the ground, and the painting could not have been completed on the freshly spread plaster while its surface was in the best state to receive and incorporate the paint. The surface must have been wetted with water admixed with a little slaked lime from time to time, while later applications of colours must have contained milk of lime. Such a process approaches closely to that known as *fresco secco*, and can be traced back to a much earlier date than can the true *buon fresco*.

We must not linger over the technical questions connected with fresco-painting as discussed by Dr. Laurie, but may now pass on to consider his criticism of the views as to old mural painting advocated by Herr Ernst Berger, in his "Maltechnik des Alterthums." These views are shown to be untenable, deriving no support either from the chemical examination of ancient examples, from modern experimental trials, or from the careful study of the language used by Pliny and by Vitruvius. The method imagined by Herr Berger was allied to the modern *stucco lustro*, and involved the use of an emulsion of beeswax, oil, and soda or potash; our author shows (pp. 107-9) that there is no valid evidence in favour of the use of this dangerous and ineffective mixture.

Dr. Laurie will, we hope, pursue his interesting and illuminating inquiries into the materials and methods of ancient painting, and of modern painting also; but in his next book will he not give us, besides such an adequate index as appears in the present work, a table of contents? This will involve the arrangement of his material in chapters or sections, which will prove more easy to study or to consult than an unbroken discussion occupying no less than 112 pages.

A. H. C.

#### OUR BOOK SHELF.

*A Monograph of the Foraminifera of the North Pacific Ocean.* Part i., *Astrorhizidæ* and *Lituolidæ*. By J. A. Cushman. Pp. xiv+134. United States National Museum Bulletin 71. (Washington: Government Printing Office, 1910.)

THIS is the first instalment of a work on the foraminiferal fauna of the North Pacific. It embodies the results of Brady, in the *Challenger* report, in so far as concerns this area, and of Goës, Flint, Rhumbler, Bagg, and others, and presents the outcome of the author's own investigations. These are based on the examination of material dredged by the United States s.s. *Albatross*, *Nero*, and *Alert*, parts of which have been already used in the reports of Goës, Flint, and Bagg.

In many cases the author extends the range of previously known species, and several are regarded as new. New generic names are given to divisions of recognised genera, particularly of the Lituolids *Haplophragmium* and *Trochammina*. Of wider interest is the author's identification of *Ammodiscus tenuis* as the megalospheric form of *A. incertus*, under which name the microscopic form has been described.

Each species is illustrated, and the figures are in most cases quite sufficient.